

VIII.3.3-RES-SNGL SINGLE RESERVOIR REGULATION OPERATION

Identifier: RES-SNGL

Operation Number: 26

Parameter Array: The FORTRAN identifier used for the parameter array for this operation is PO.

<u>Position</u>	<u>Description</u>
PO(1)	Operation version number
PO(2) thru PO(6)	Operation title
PO(7)	Operation data time interval (units of HR)
PO(8)	Units used when operation was defined: -1 = English (storage contents units of CFSD) 0 = English (storage contents units of ACFT) 1 = Metric
PO(9)	Scheme/Utility specific information pointer in PO array
PO(10)	General parameters pointer in PO array
PO(11)	General time-series information pointer in PO array
PO(12)	RCL STATEMENT pointer in PO array
PO(13)	USER VARIABLES pointer in PO array: 0 = none used
PO(14)	IF EXPRESSION pointer in PO array: 0 = none used
PO(15)	Number of carryover values (general and specific) needed
PO(16)	Number of words of work space needed
PO(17)	Rating Curve information pointer
PO(18) thru PO(19)	Unused
PO(20)	Number of Scheme/Utilities used in this operation definition (NSU). Next four values are Scheme/Utility-specific information pointers and are repeated NSU times:

<u>Position</u>	<u>Description</u>
PO(20+(ISU-1)*4+1)	Scheme/utility identifier code (ISU is the input sequential number of this Scheme/Utility)
PO(20+(ISU-1)*4+2)	ISU specific parameters pointer in PO array: 0 = no specific parameters used
PO(20+(ISU-1)*4+3)	ISU specific time-series pointer in PO array: 0 = no specific time series used
PO(20+(ISU-1)*4+4)	ISU specific carryover pointer in CO array: 0 = no specific carryover used
PO(PO(10)) thru PO(PO(11)-1)	Organized with general parameters first followed by specific parameters from each Scheme/Utility defined in the order each Scheme/Utility was entered (see Section VIII.3.3-RES-SNGL-PO1 for detailed information)
PO(PO(10)) (N)	Number of pairs of elevation/storage curve
PO(PO(10)+1 thru PO(PO(10)+N)	N values of pool elevations (units of M)
PO(PO(10)+N+1) thru PO(PO(10)+2N)	N values of pool storage (units of CMSD)
PO(PO(10)+2N+1)	Interpolation option: 0 = linear 1 = logarithmic
PO(PO(10)+2N+2) thru PO(PO(11)-1)	Specific parameter information for each Scheme/Utility
PO(PO(11) thru general	Time series information organized with PO(PO(12)-1) time series first followed by specific time series from each Scheme/Utility defined in the order entered (see Section VIII.3.3-RES-SNGL-PO1 for detailed information)
PO(PO(11))	Number of general time series and specific time series defined (NTS)
Beginning with NEXT=PO(11) the following values are repeated NTS times:	
PO(NEXT+1) thru PO(NEXT+2)	Time series identifier: blank = not used
PO(NEXT+3)	Time series data type (omitted if time series not used): blank = not used

<u>Position</u>	<u>Description</u>
PO(NEXT+4)	Time series data time interval (omitted if time series is not used) (units of HR)
PO(NEXT+5)	Input/output indicator (omitted if time series not used): 0 = input time series 1 = output time series
	NEXT=NEXT+NW NW=2 for blank time series NW=5 for nonblank time series
PO(PO(12)) thru PO(PO(13)-1)	RCL statements in numerical code (see Section VIII.3.3-RES-SNGL-PO2 for detailed information)
PO(PO(13)) thru PO(PO(14)-1)	User variable information (see Section VIII.3.3- RES-SNGL-PO4 for detailed information)
PO(PO(13))	Total number of user variable groups (NVG)
Beginning with NEXT=PO(13) the following values are repeated NVG times:	
PO(NEXT+1)	User variable type: 1 = constant value with no name 2 = constant value with name 3 = function where value needs to be computed- name indicates what function
PO(NEXT+NW)	Variable information: NW=2 for type 1 (value + unit conversion code) NW=5 for type 2 (3 name + value + unit conversion code) NW=3 for type 3 (function code + mathematical operation code + factor)
	NEXT=NEXT+NW+1
PO(PO(14)) thru PO(PO(17))	IF EXPRESSION groups (see Section VIII.3.3-RES-SNGL-PO3 for detailed information)
PO(PO(14))	Total number of IF EXPRESSION groups (NIF)
Beginning with NEXT=PO(14) the following values are repeated NIF times:	
PO(NEXT+1)	Total number of values in this group (NW)
PO(NEXT+NW)	encoded IF EXPRESSION (NW values)

<u>Position</u>	<u>Description</u>
	NEXT=NEXT+NW+1
PO(PO(17)) thru (IUSEP-1)	Rating Curve information
PO(PO(17))	Total number of rating curves used in this operation definition (NR)
PO(PO(17)+(IR-1)+1) thru PO(PO(17)+(IR-1)+2)	Rating Curve identifiers

Carryover Array: The FORTRAN Identifier used for the carryover array is CO. The carryover array consists of general carryover and specific carryover. General carryover starts at position 1 of the CO array and uses six values. Specific carryover starts at position 7 of the CO array. The start of specific carryover within the CO array for a particular Scheme/Utility is held in the Scheme/Utility pointer section of the PO array (see Section VIII.3.3-RES-SNGL-PO1). The total number of specific carryover values vary with the type and number Scheme/Utility used in this operation definition. The contents of the CO array are:

<u>Position</u>	<u>Description</u>
CO(1)	Instantaneous inflow at start of run (units of CMS)
CO(2)	Mean discharge at start of run (units of CMS)
CO(3)	Instantaneous discharge at start of run (units of CMS)
CO(4)	Pool elevation one period before start of run (units of M)
CO(5)	Pool elevation at start of run (units of M)
CO(6)	Pool storage at start of run (units of CMSD)
CO(PO(20)+(ISU-1)*4+4)	Specific carryover for Scheme/Utility ISU (repeated NSU times where NSU=PO(20)) (see Section VIII.3.3-RES-SNGL-CO for detailed information)

Subroutine Names and Functions: The subroutines associated with this Operation are as follows:

<u>Subroutine</u>	<u>Function</u>
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<u>Subroutine</u>	<u>Function</u>
ARUL26	Computes rulecurve adjustment
ASCN26	Checks and assures values entered in ascending order
BDRC26	Determines upper and lower elevations in rulecurve
CARD26	Reads input cards and writes to unit 89
CKNM26	Checks for valid codes in IF EXPRESSION
CKRC26	Checks if rating curve is allowed to be input
CKST26	Checks pool storage against upper and lower limiting storages
CMPS26	Translates and stores the USER VARIABLE into the work array
CNVT26	Converts CMSD to CFSD or ACFT
CONV26	Converts 24-hour mean outflow into time interval mean outflow
COXX26	Gets and checks carryover data for Scheme/Utility #xx
DSCN26	Checks and assures values entered in descending order
EDST26	Computes maximum permissible discharge from dam
ELST26	Checks and assures elevations are within elevations are within elevation versus storage curve
EROT26	Prints out error messages occurred in PIN26
ERUL26	Computes rulecurve elevations
EVAA26 EVAB26 EVAC26	Utility subroutines used for induced surcharge elevation options
EVSQ26	Determine outflow from pool elevation discharge relation
EX26	Execution routine for single reservoir operation
FCMP26	Counts and returns the number of characters in a string
FCNRCF	Converts real values into their character representation
FCONIC FILL26	Converts integers into their character representation Reservoir fill and spill scheme

<u>Subroutine</u>	<u>Function</u>
FLOC26	Determines scheme and level number of a previously defined scheme
FLSH26	Computes outflow from a dam with flashboards
FLWK26	Stores one value in an array and determines if available space is exceeded
FPCV26	Punches input cards containing sets of values such as rating curve, rulecurve, etc.
FPOP26	Moves every element in array up one position
FPR26	Prints the reservoir command language stored in the P array
FPUS26	Adds one more value to a stack
FRAC26	Computes time fraction for the pool to rise or fall to a specified storage
FRCL26	Copies character-by-character from IN array into OUT array (starting at position LORCL in OUT)
F3WAYX F3WAYY F3WAYZ	Interpolates values in a three-way relation
GC026	Reads and stores general carryover values
GENL26	Reads all input in general section of Operation 26
GLST26	Gets list of items (integer, real or character)
GOFL26	Determines if the program should go to flash board scheme
GPAR26	Reads and stores general parameters
GTS26	Reads and stores general time-series information
ICLK26	Function for evaluating A.GT.B type integer relation
IDCK26	Checks the restrictions on a SET variable name
IDWP26	Checks for valid ID with or without level specification
IKEY26	Function to look for match in array of values
IOFF26	Computes offset from beginning of user variable section for a specific user variable
ITRP26	Determines location of a given value in a curve

<u>Subroutine</u>	<u>Function</u>
LEAP26	Function to see if Julian date and hour fall within leap year
MATH26	Performs addition, subtraction, multiplication or division of two values of user variables in RCL
MAXV26	Determines maximum number of values used in spillway curve
MLTS26	Determines multiple definitions of time series
MOVE26	Moves a string of values from one array to another
MPAR26	Performs syntactical and lexical analysis of IF EXPRESSION
MREF26	Checks on reference to a potentially multiply defined curve
MTWT26	Determines numerical day of week from Julian day and hour
NDUC26	Computes outflow from an induced surcharge scheme
NTER26	Performs linear or logarithmic interpolation
O26BLK	Block data
OBSV26	Indicator for missing/non-missing observed pool storage
OSOH26 relation	Computes outflow versus storage and outflow/2
OVER26	Computes outflow over spillway
PASN26	Performs pass inflow computation
PIN26	Inputs subroutine for single reservoir operation
PMXX26	Reads and interprets parameter input for Scheme/Utility #XX
POSN26	Positions unit to proper line of subsequent reading
POST26	Computes work space needed and does post-input processing
PRC26	Prints carryover information
PRCL26	Outputs a line of RCL if array has been filled
PREL26	Prescribes pool elevation

<u>Subroutine</u>	<u>Function</u>
PREQ26	Prescribes reservoir discharge
PRP26	Prints the information stored in the P array
PRPB26	Prints stage and pool elevation controlled outflow scheme (#08)
PRPC26	Prints discharge minimization scheme (#09)
PRPD26	Prints upstream stage minimization scheme (#10)
PRPE26	Prints induced surcharge scheme (#11)
PRPF26	Prints flash board scheme (#12)
PRPG26	Prints power generation scheme (#13)
PRPU26	Prints all utilities
PUC26	Punches input cards in the format required by PIN26
QGEN26	Performs power generation outflow computation
QMIN26	Minimizes the peak outflow from a dam
RCHK26	Function to elevate A.GT.B type relation for real values
RCL26	Reads, interprets, analyzes and encodes RCL input
RFIL26	Stores a value in an array, if no errors found
RPN26	Fills IF EXPRESSION section of work array with IF EXPRESSION in Reverse Polish Notation
RULE26	Determines pool elevation from rulecurve
RUTE26	Performs modified PULS reservoir routing
SPEC26	Reads all input for SPECIFIC section of Operation 26
STER26	Identifies error due to a specific Scheme/Utility occurring in PIN26
STOR26	Transfers parameter information from work array in PO and CO array
STRN26	Identifies error due to key words used by all schemes/utilities occurring in PIN26
STWN26	Adds to a list of warnings occurring in PIN26
SUMO26	Computes outflow volume to bring pool back to rulecurve elevation

<u>Subroutine</u>	<u>Function</u>
SURC26	Determines if the program should go to induced surcharge scheme
SUXX26	Calls subroutines PMXX, TSXX and COXX for Scheme/Utility #XX
TERP26	Performs linear interpolation/extrapolation
TRAN26	Transfers all input for RES-SNGL operation from unit 5 to unit 6
TSID26	Gets the identifier, data type and time interval from a line of input
TSXX26	Reads and checks time series specifications for Scheme/Utility #XX
UAFT26	Returns the string following specified character in A4 format
UBEF26	Returns the string preceding specified character in A4 format
UDO26	Gets the next field and checks on the ID's validity (both in name and definition)
UFLD26	Gets next field on a line of input by calling UFIELD
UIF26	Interprets, analyses and encodes IF-ENDIF blocks in RCL
UMSN26	Minimizes the crest stage during flooding condition
USCH26	Searches for a character in a string
USET26	Determines the name and value of SET variable
WKSP26	Computes amount of work space needed by RES-SNGL
WNOT26	Prints warning messages occurring in PIN26
XADJ26	Adjusts instantaneous Q so that adjusted daily volume matches observed daily volume
XAD026	Outputs adjusted values to time series if needed
XBLV26	Determines base number (1-24) and level of definition from Scheme/Utility code number
XCMA26	Computes areas from elevation versus storage curve
XCMQ26	Computes elevation versus maximum (total or generation) discharge curve

<u>Subroutine</u>	<u>Function</u>
XCOU26	Performs default carryover updates and carryover save at end of each time period
XCTQ26	Computes a total Q versus Maximum generation Q curve
XDCO26	Sets up information for default carryover for Scheme/Utility not executed in a time period
XDOL26	Assigns work space locations for amounts for EX26
XDO26	Executes the DO statement
XENT26	Computes the ENTRY-INTO-SURCHARGE curve
XFMQ26	Generates the elevation versus maximum (total or generation) discharge curve
XFRU26	Computes and stores the rule curve elevations for every time period
XFTQ26	Generates total Q versus maximum generation Q curve
XGCV26	Determines value for user variable in A.GT.B relation
XIFG26	Determines result of IF EXPRESSION
XIF26	Processes IF EXPRESSION (including all embedded IFs)
XINQ26	Determines inflow values for time period
XMAX26	Determines maximum number of points in spillway curves
XM126	Executes SETQMEAN MOD for time period
XNIT26	Initializes variables for execution of RES-SNGL
XOUT26	Outputs time series generated by BACKFLOW and RAINEVAP utility
XPOP26	Removes first element by moving every element in array up by one position for RPN processing
XPRE26	Performs PRE-TIME-INTERVAL-LOOP tasks (i.e., executes pertinent utilities)
XPTR26	Determines start location of PARMS, TIME SERIES and CARRYOVER for a specific Scheme/Utility in PO and CO array
XPUS26	Adds one element to the top of stack for RPN processing
XQT26	TIME-INTERVAL-LOOP execution controller

<u>Subroutine</u>	<u>Function</u>
XRCL26	Scans RCL to determine RES-SNGL model outputs
XREV26	Performs preliminary calculations for RAINEVAP utility
XRIN26	Reconfigures inflows after RAINEVAP utility execution
XS0126	Executes pass inflow scheme
XS0226	Executes prescribed discharge scheme
XS0326	Executes prescribed pool elevation scheme
XS0426	Executes rulecurve scheme
XS0526	Executes fill and spill scheme
XS0626	Executes spillway routing scheme
XS0726	Executes POOLQ scheme - discharge from pool elevation from pool elevation versus discharge curve
XS0826	Executes downstream stage and pool Q scheme
XS0926	Executes discharge minimization scheme
XS1026	Executes upstream stage minimization scheme
XS1126	Executes induced surcharge scheme
XS1226	Executes flash board control scheme
XS1326	Executes power generation scheme
XSM026	Outputs simulated results to time series
XSOH26	Computes modified PULS curve (O versus S+O/2) from elevation versus discharge curve
XSPT26	Sets up direct look-up tables for locations in PO array for all schemes/utilities
XSRT26	Sorting routine used by FLASHBDS scheme
XTSS26	Computes and sets time series pointers
XU1426	Executes rule curve adjust utility
XU1526	Executes inflow summation utility
XU1626	Executes rainfall/evaporation utility
XU1726	Executes adjust utility

<u>Subroutine</u>	<u>Function</u>
XU1826	Executes back-computed inflow utility
XU2026	Executes maximum dam outflow utility
XU2126	Executes entry into induced surcharge utility
XU2226	Executes set minimum element utility
XU2326	Executes set maximum element utility
XU2426	Executes entry into flash board utility
X17B26	Performs blending using simulated and observed discharge
X17E26	Computes storage and elevation using continuity equation
X17I26	Adjusts simulated instantaneous discharge using observed instantaneous discharge
X17M26	Computes mean discharge by averaging instantaneous discharge
X17N26	Interpolates differences/ratios between observed end points
X17S26	Computes daily means from period means